

## Introdução/Introduction

Hops (*Humulus Lupulus*) is used as a flavoring and stability agent in beer imploring also its different aromas and flavors. Additionally, hops can be used for various other purposes, such as a herbal medicine thanks to its antibacterial effect. This study focuses mainly on its antibacterial effect and bioactivity and whether it can be used in cosmetical formulations.

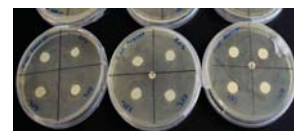
## Objetivos/Objectives

The main purpose of this study was to prepare gel formulations combined with phenolic extracts of the *Humulus Lupulus* plant (both flowers and vegetative parts) and analyze their stability and antimicrobial activity. In addition, phenolic composition of the extracts was determined.

## Material e Métodos /Material and Methods



- Preparation of extracts by solid-liquid extraction with an 80% etanolic solution
  - Varieties: Chinook, Cascade, Polaris, Centennial, Nugget, and
  - Spontaneous
- Analysis of phenolic compounds by Folin-Ciocalteu and LC-MS<sup>n</sup> methods [2]
- Determination of stability of Carbopol and Methyl-celulose gels
- Antimicrobial activity determination of gels for *E.coli* and *C. albicans*



## Resultados/Results

Table 1. Total Phenolic compounds determined

Sample	Total Phenolic Compounds (mg GAE/g dried plant)	
	Vegetative parts	Flowers
Cascade	2.05±0.66	10.39±2.05
Polaris	1.05±0.22	22.71±2.44
Centennial	1.65±0.38	9.68±1.61
Nugget	0.84±0.24	14.80±1.06
Chinook	1.75±0.50	-
Spontaneous	3.08±0.53	-

- The gels presented a good stability through a series of verified tests (pH, density, temperature and light).
- E.coli* was more sensitive to the formulations than *C. albicans*



Table 2. Antimicrobial effect of gel formulations against *E. coli*

Sample	2.50%	5%	7.50%
Cascade FW	0.25±0.13 cm	0.1±0.06 cm	0.16±0.01 cm
Cascade VP	0.14±0.06 cm	0.16±0.02 cm	0.12±0.01 cm
Polaris FW	0.14±0.06 cm	0.15±0.05 cm	0.05±0.0 cm
Polaris VP	0.09±0.02 cm	0.11±0.01 cm	0.08±0.0 cm
Centennial FW	0.29±0.08 cm	0.28±0.1 cm	0.25±0.0 cm
Centennial VP	0.06±0.05 cm	0.12±0.03 cm	0.1±0.0 cm
Nugget FW	0.14±0.08 cm	0.17±0.01 cm	0.13±0.05 cm
Chinook VP	0.15±0.04 cm	0.11±0.03 cm	0.12±0.04 cm
Spontaneous VP	0.75 cm	0.12±0.05 cm	0.24±0.11 cm

FW - Flowers; VP - Vegetative parts

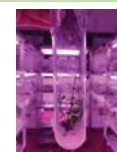
- The hops were more concentrated in phenolic compounds rather than their vegetative parts;
- LC-MS<sup>n</sup> data showed that flower extracts of cascade variety are rich in quercetin and kaempferol glycosides.



## Conclusões/ Conclusions

In conclusion the gels are stable in time and can be used as a main part of cosmetic formulation by further research.

*Humulus lupulus* can be used for various other purposes, such as a herbal medicine thanks to its antibacterial effect.



## Referências/ References

- [1] Almaguer, C. et al (2014). *Humulus lupulus* - a story that begs to be told. A review. J. Institute of Brewing, 120(4), 289–314;  
[2] Afonso, A. et al. (2017). Health-Promoting Effects of *Thymus herba-barona*, *Thymus pseudolanuginosus*, and *Thymus caespititius* Decoctions. Int. J. Mol. Sci. 2017, 18, 1879.

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